10/520661

Inventor: Masahiko HAMANAKA
Title: IMAGE MATCHING SYSTEM USING THREE-DIMENSIONAL OBJECT MODEL IMAGE MATCHING METHOD, AND IMAGE MATCHING PROGRAM Filed: January 10, 2005
SUGHRUE MION REFERENCE No. Q85625
Sheet 1 of 19

FIG. 1

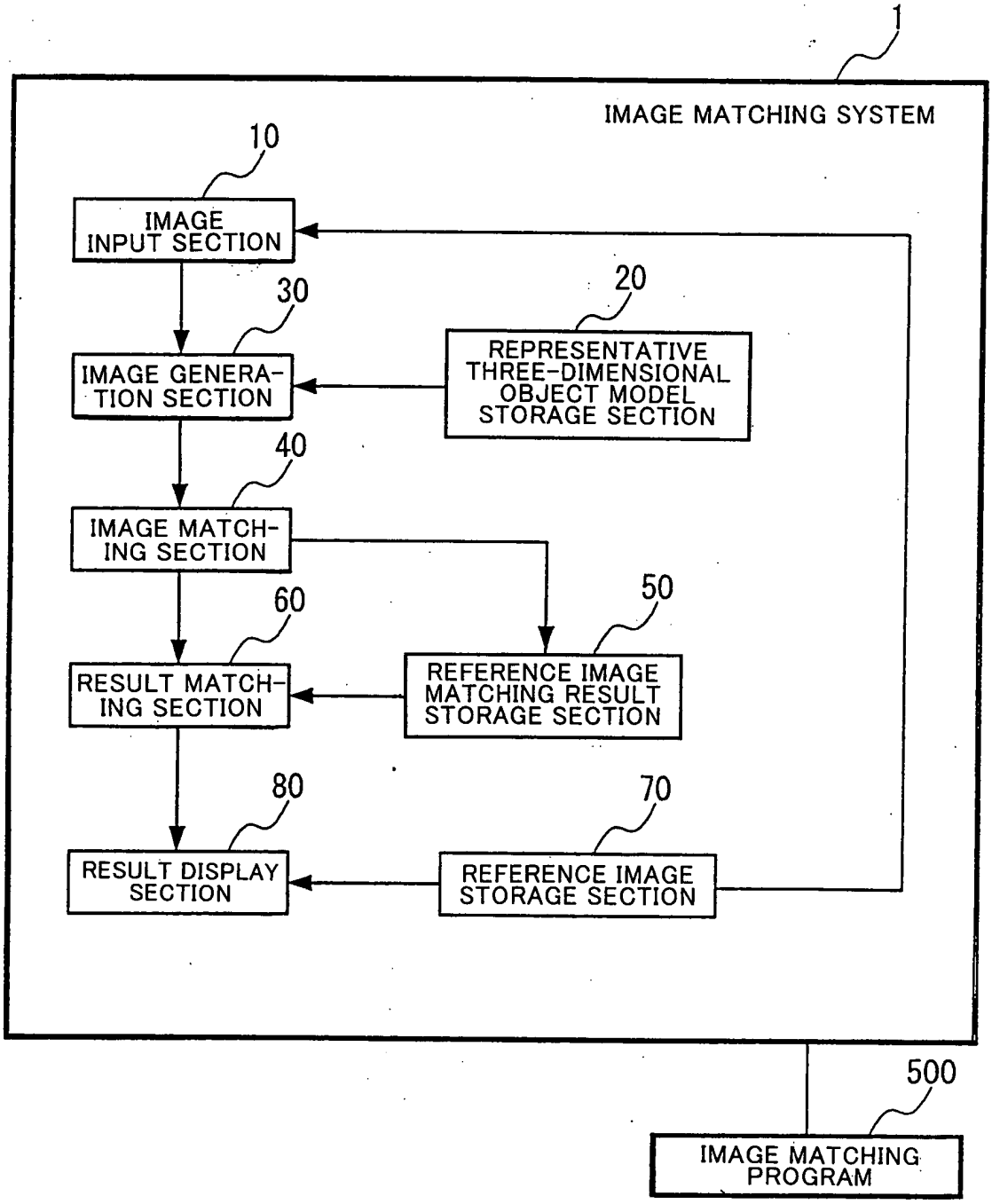

FIG.2

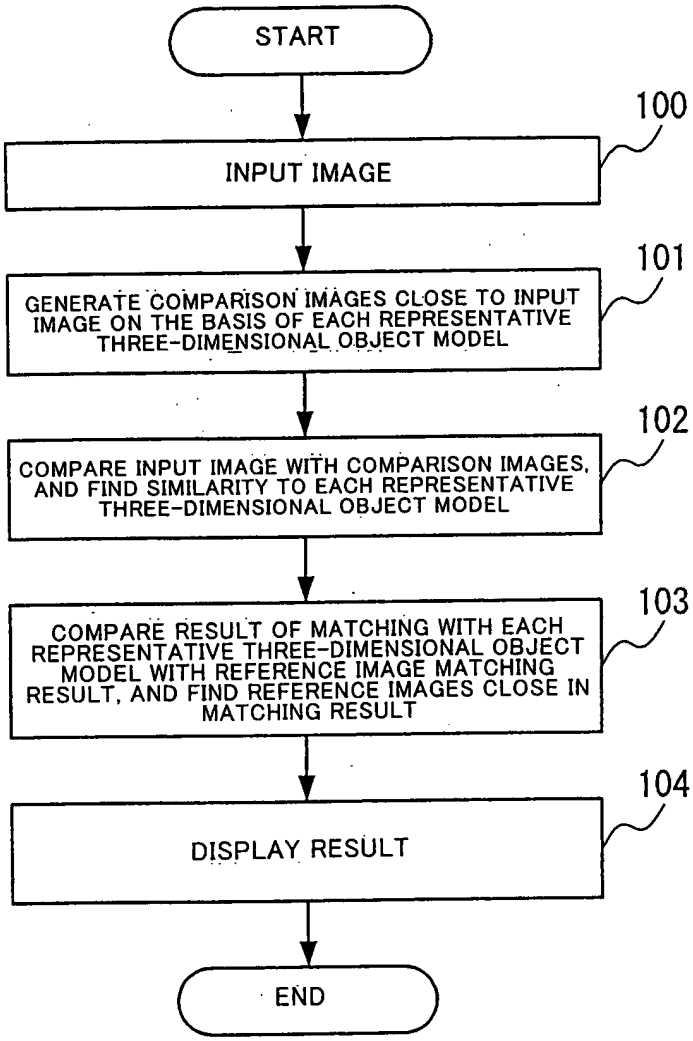
START
100
INPUT IMAGE
101
GENERATE COMPARISON IMAGES CLOSE TO INPUT IMAGE ON THE BASIS OF EACH REPRESENTATIVE THREE-DIMENSIONAL OBJECT MODEL
102
COMPARE INPUT IMAGE WITH COMPARISON IMAGES, AND FIND SIMILARITY TO EACH REPRESENTATIVE THREE-DIMENSIONAL OBJECT MODEL
103
COMPARE RESULT OF MATCHING WITH EACH REPRESENTATIVE THREE-DIMENSIONAL OBJECT MODEL WITH REFERENCE IMAGE MATCHING RESULT, AND FIND REFERENCE IMAGES CLOSE IN MATCHING RESULT
104
DISPLAY RESULT
END

FIG.3

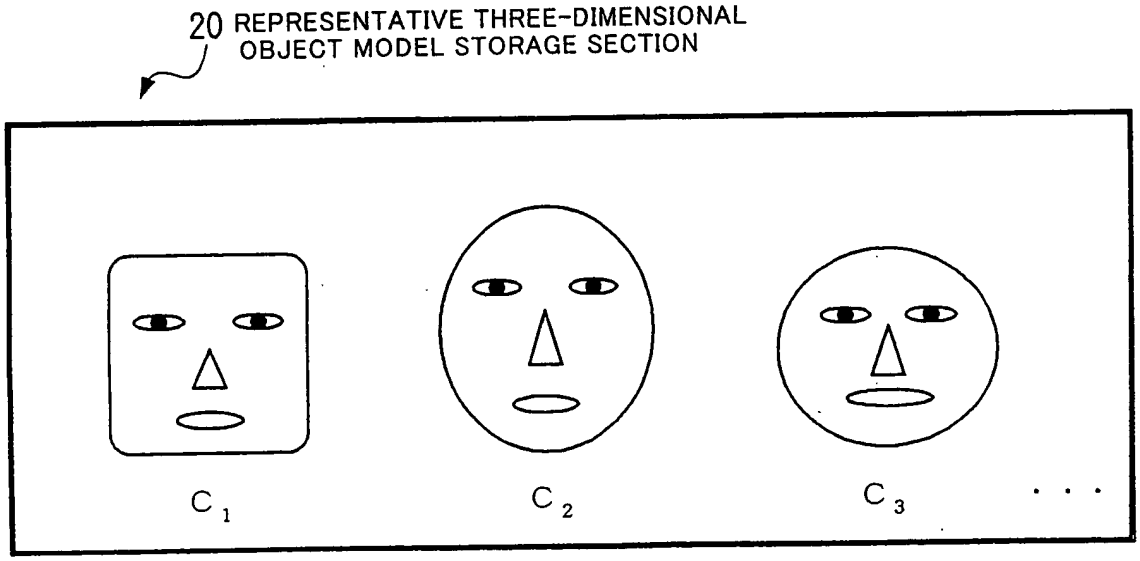
20 REPRESENTATIVE THREE-DIMENSIONAL OBJECT MODEL STORAGE SECTION
C1
C2
C3
. . .

FIG.4

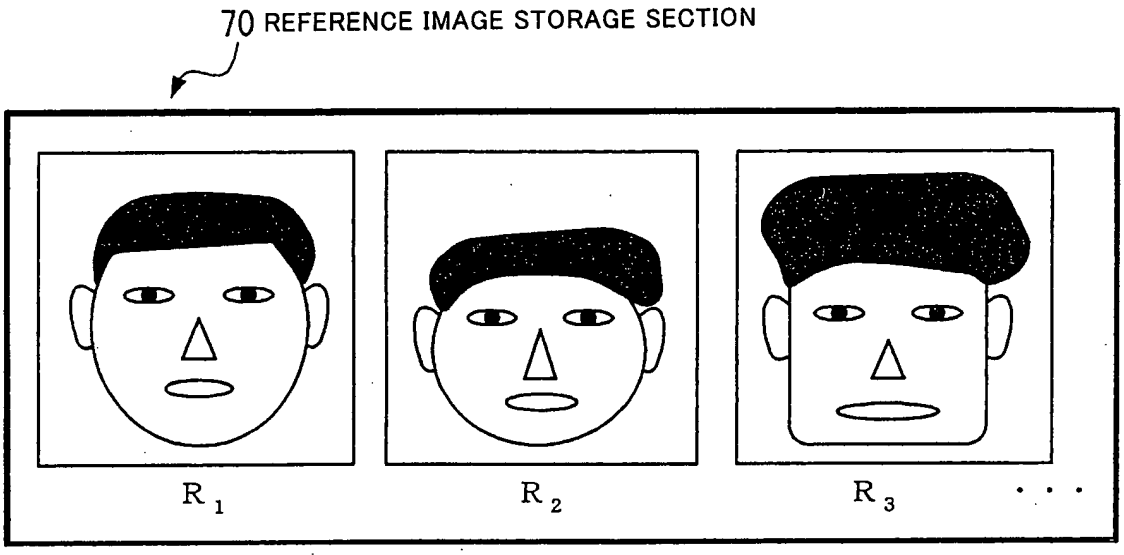

FIG.5

50 REFERENCE IMAGE MATCHING RESULT STORAGE SECTION

REFERENCE IMAGE NUMBER	OBJECT MODEL NUMBER AND SIMILARITY			
	FIRST PLACE	SECOND PLACE	THIRD PLACE	• • •
R_1	C_2 : 0.98	C_5 : 0.96	C_3 : 0.95	
R_2	C_3 : 0.95	C_2 : 0.93	C_{10} : 0.90	
R_3	C_1 : 0.97	C_9 : 0.96	C_8 : 0.93	
.				
.				
.				

FIG.6

INPUT IMAGE

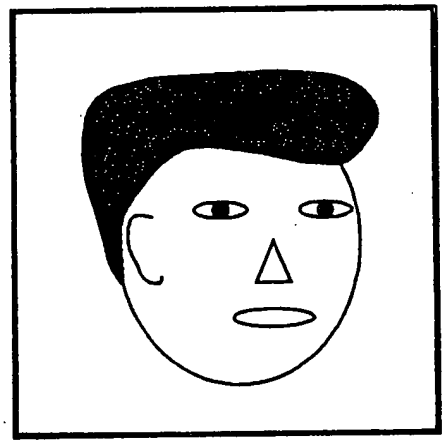

FIG.7

	OBJECT MODEL NUMBER AND SIMILARITY FIRST PLACE SECOND PLACE THIRD PLACE ・・・
INPUT IMAGE	C_2 : 0.96 C_5 : 0.94 C_3 : 0.92

FIG.8

	REFERENCE IMAGE NUMBER AND SIMILARITY FIRST PLACE SECOND PLACE THIRD PLACE ・・・
INPUT IMAGE	R_1 : 0.92 R_5 : 0.89 R_2 : 0.87

FIG.9

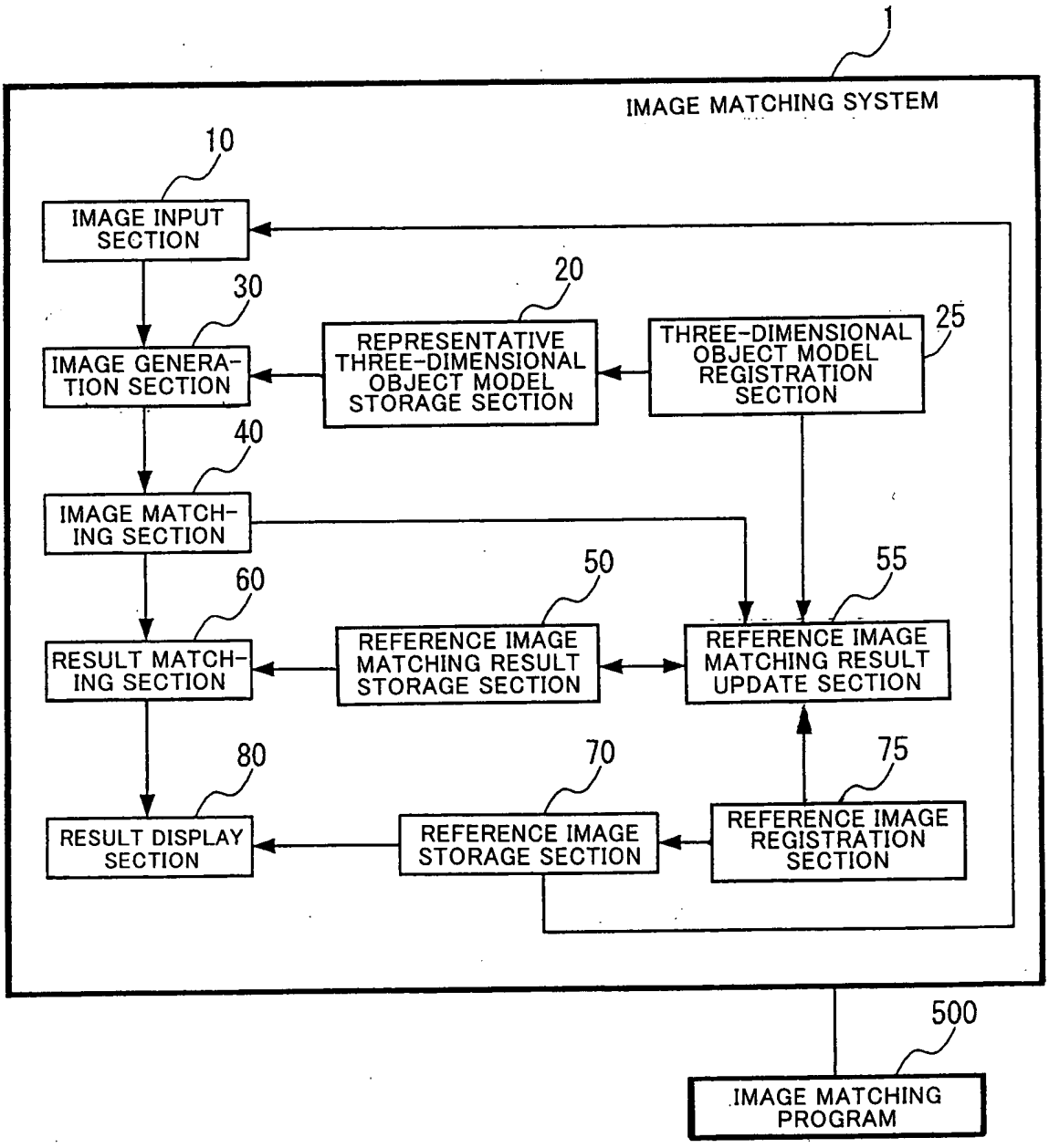
1
IMAGE MATCHING SYSTEM
10
IMAGE INPUT SECTION
30
IMAGE GENERATION SECTION
20
REPRESENTATIVE THREE-DIMENSIONAL OBJECT MODEL STORAGE SECTION
25
THREE-DIMENSIONAL OBJECT MODEL REGISTRATION SECTION
40
IMAGE MATCHING SECTION
60
RESULT MATCHING SECTION
50
REFERENCE IMAGE MATCHING RESULT STORAGE SECTION
55
REFERENCE IMAGE MATCHING RESULT UPDATE SECTION
80
RESULT DISPLAY SECTION
70
REFERENCE IMAGE STORAGE SECTION
75
REFERENCE IMAGE REGISTRATION SECTION
500
IMAGE MATCHING PROGRAM

FIG.10

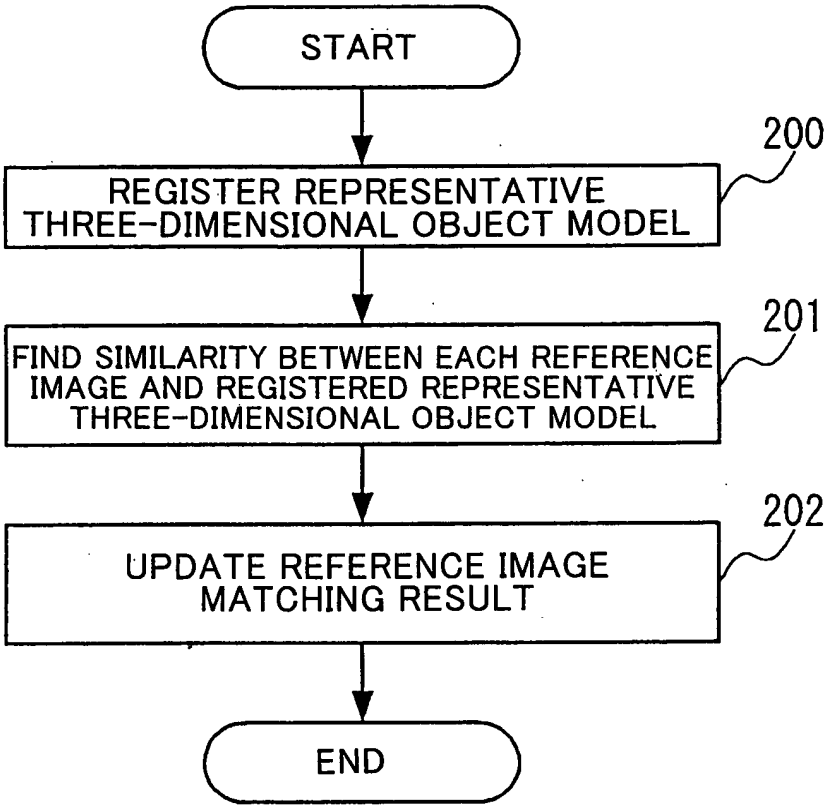
START
200
REGISTER REPRESENTATIVE THREE-DIMENSIONAL OBJECT MODEL
201
FIND SIMILARITY BETWEEN EACH REFERENCE IMAGE AND REGISTERED REPRESENTATIVE THREE-DIMENSIONAL OBJECT MODEL
202
UPDATE REFERENCE IMAGE MATCHING RESULT
END

FIG.11

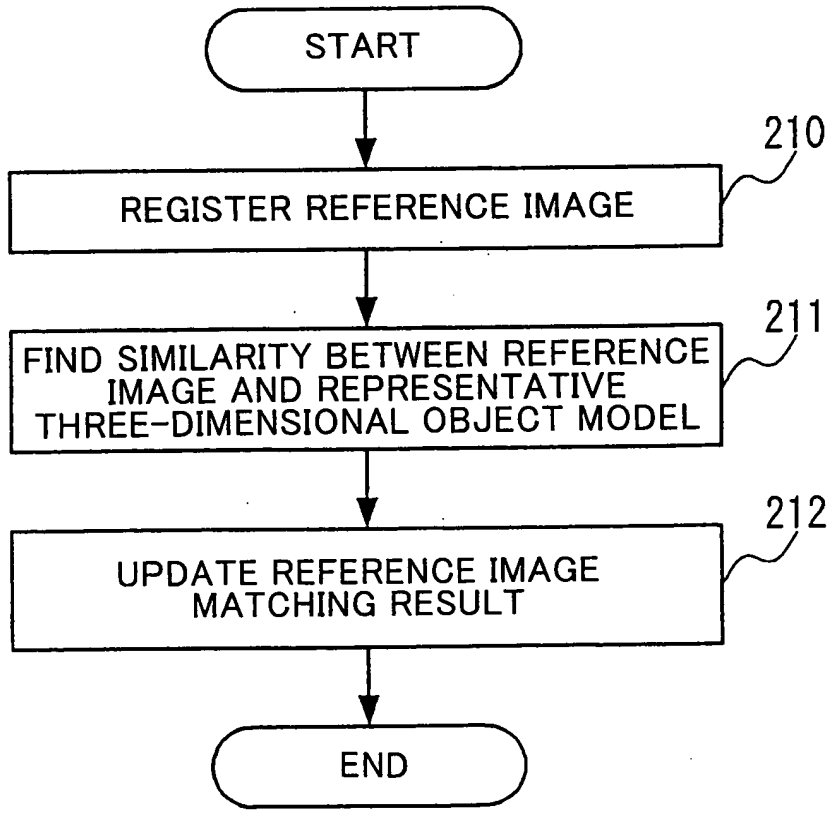
START
210
REGISTER REFERENCE IMAGE
211
FIND SIMILARITY BETWEEN REFERENCE IMAGE AND REPRESENTATIVE THREE-DIMENSIONAL OBJECT MODEL
212
UPDATE REFERENCE IMAGE MATCHING RESULT
END

FIG.12

REFERENCE IMAGE NUMBER	OBJECT MODEL NUMBER AND SIMILARITY
R_1	C_{51} : 0.97
R_2	C_{51} : 0.92
R_3	C_{51} : 0.83
・	
・	
・	

FIG.13

50 REFERENCE IMAGE MATCHING RESULT STORAGE SECTION

REFERENCE IMAGE NUMBER	OBJECT MODEL NUMBER AND SIMILARITY		
	FIRST PLACE	SECOND PLACE	THIRD PLACE ・・・
R_1	C_2 : 0.98	C_{51} : 0.97	C_5 : 0.96
R_2	C_3 : 0.95	C_2 : 0.93	C_{51} : 0.92
R_3	C_1 : 0.97	C_9 : 0.96	C_8 : 0.93
・			
・			

FIG.14

REFERENCE IMAGE NUMBER	OBJECT MODEL NUMBER AND SIMILARITY		
	FIRST PLACE	SECOND PLACE	THIRD PLACE ・・・
R_{101}	C_2 : 0.99	C_6 : 0.98	C_3 : 0.96

FIG. 15

50 REFERENCE IMAGE MATCHING RESULT STORAGE SECTION

REFERENCE IMAGE NUMBER	OBJECT MODEL NUMBER AND SIMILARITY			
	FIRST PLACE	SECOND PLACE	THIRD PLACE	・・・
R_1	C_2 : 0.98	C_5 : 0.96	C_3 : 0.95	
R_2	C_3 : 0.95	C_2 : 0.93	C_{10} : 0.90	
R_3	C_1 : 0.97	C_9 : 0.96	C_8 : 0.93	
・		・		
・		・		
R_{101}	C_2 : 0.99	C_6 : 0.98	C_3 : 0.96	

FIG. 16

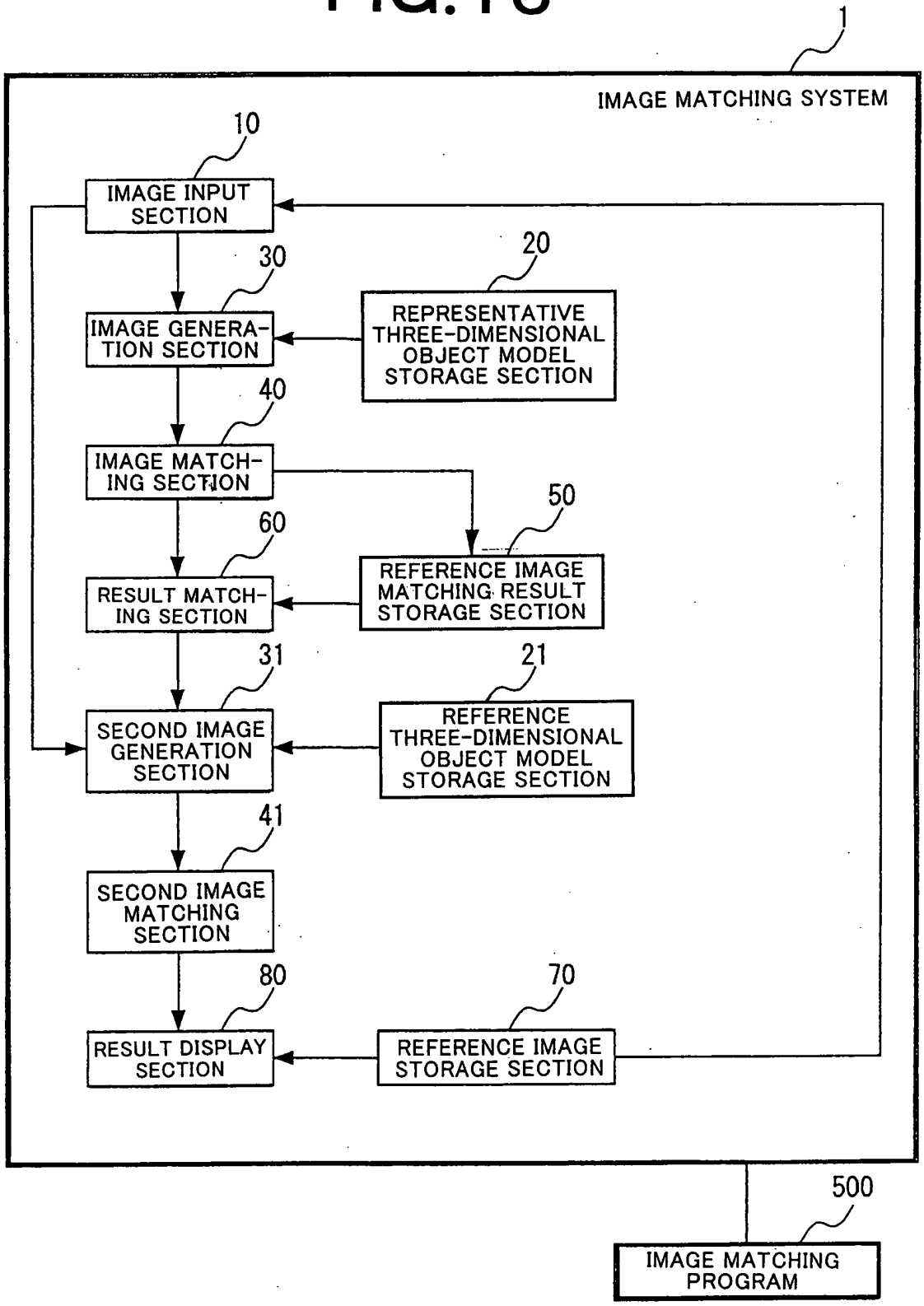
1
IMAGE MATCHING SYSTEM
10
IMAGE INPUT SECTION
30
IMAGE GENERATION SECTION
20
REPRESENTATIVE THREE-DIMENSIONAL OBJECT MODEL STORAGE SECTION
40
IMAGE MATCHING SECTION
50
60
RESULT MATCHING SECTION
REFERENCE IMAGE MATCHING RESULT STORAGE SECTION
31
21
SECOND IMAGE GENERATION SECTION
REFERENCE THREE-DIMENSIONAL OBJECT MODEL STORAGE SECTION
41
SECOND IMAGE MATCHING SECTION
80
70
RESULT DISPLAY SECTION
REFERENCE IMAGE STORAGE SECTION
500
IMAGE MATCHING PROGRAM

FIG.17

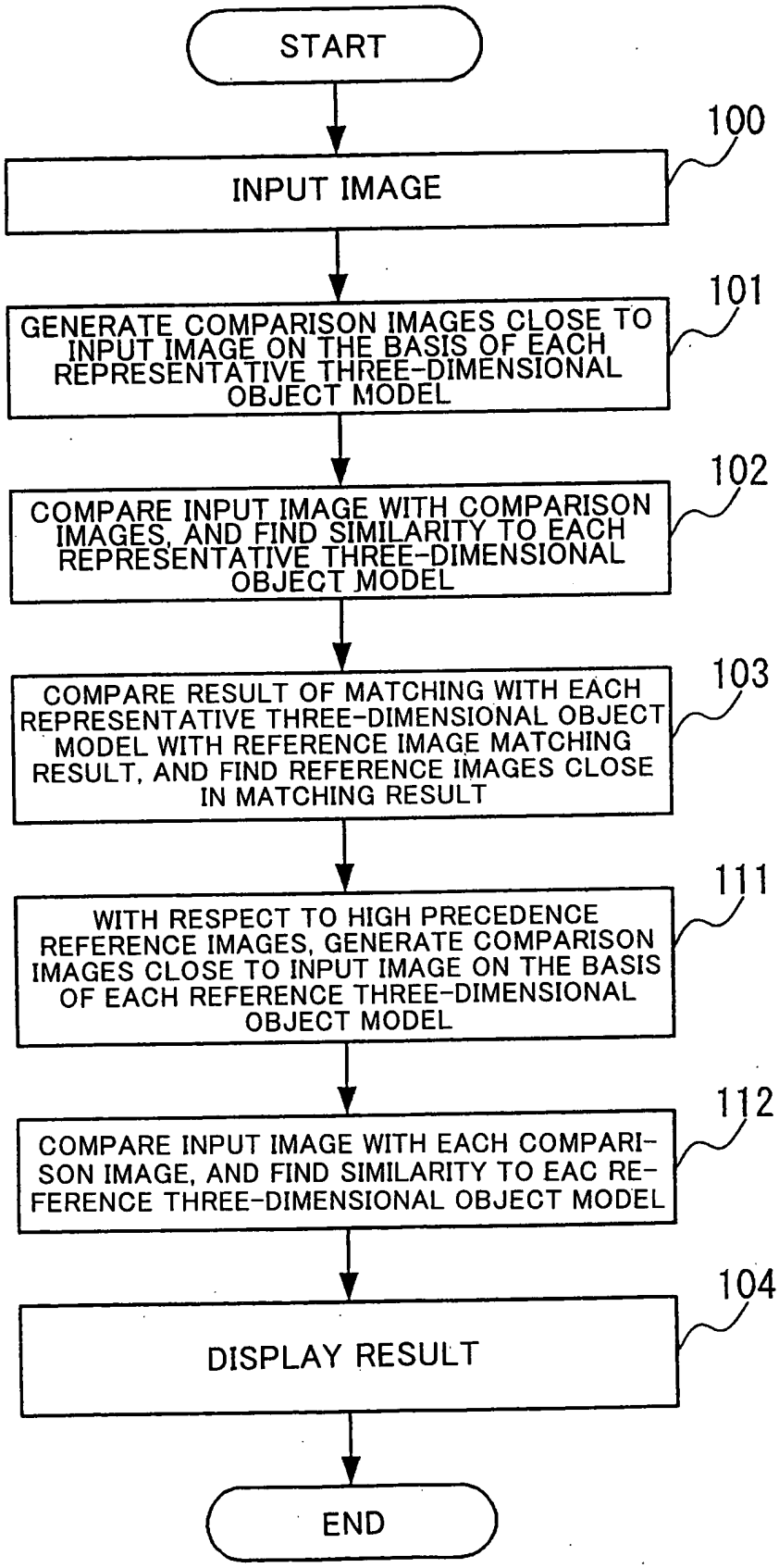
START
100
INPUT IMAGE
101
GENERATE COMPARISON IMAGES CLOSE TO INPUT IMAGE ON THE BASIS OF EACH REPRESENTATIVE THREE-DIMENSIONAL OBJECT MODEL
102
COMPARE INPUT IMAGE WITH COMPARISON IMAGES, AND FIND SIMILARITY TO EACH REPRESENTATIVE THREE-DIMENSIONAL OBJECT MODEL
103
COMPARE RESULT OF MATCHING WITH EACH REPRESENTATIVE THREE-DIMENSIONAL OBJECT MODEL WITH REFERENCE IMAGE MATCHING RESULT, AND FIND REFERENCE IMAGES CLOSE IN MATCHING RESULT
111
WITH RESPECT TO HIGH PRECEDENCE REFERENCE IMAGES, GENERATE COMPARISON IMAGES CLOSE TO INPUT IMAGE ON THE BASIS OF EACH REFERENCE THREE-DIMENSIONAL OBJECT MODEL
112
COMPARE INPUT IMAGE WITH EACH COMPARISON IMAGE, AND FIND SIMILARITY TO EAC REFERENCE THREE-DIMENSIONAL OBJECT MODEL
104
DISPLAY RESULT
END

FIG.18

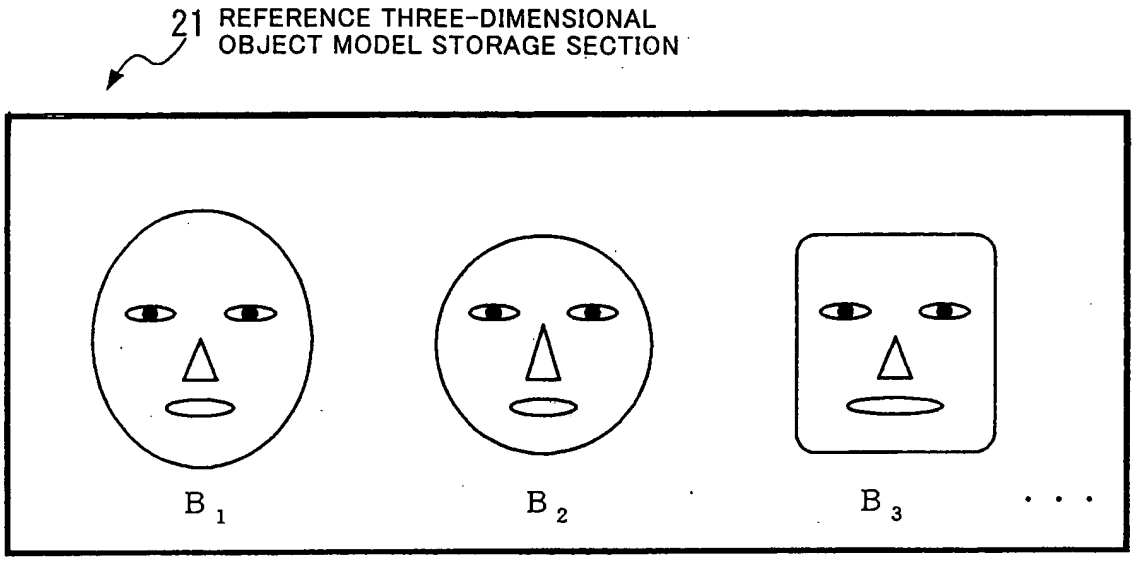

FIG.19

	OBJECT MODEL NUMBER AND SIMILARITY			
	FIRST PLACE	SECOND PLACE	THIRD PLACE	• • •
INPUT IMAGE	B_5 : 0.99	B_1 : 0.98	B_2 : 0.96	

FIG.20

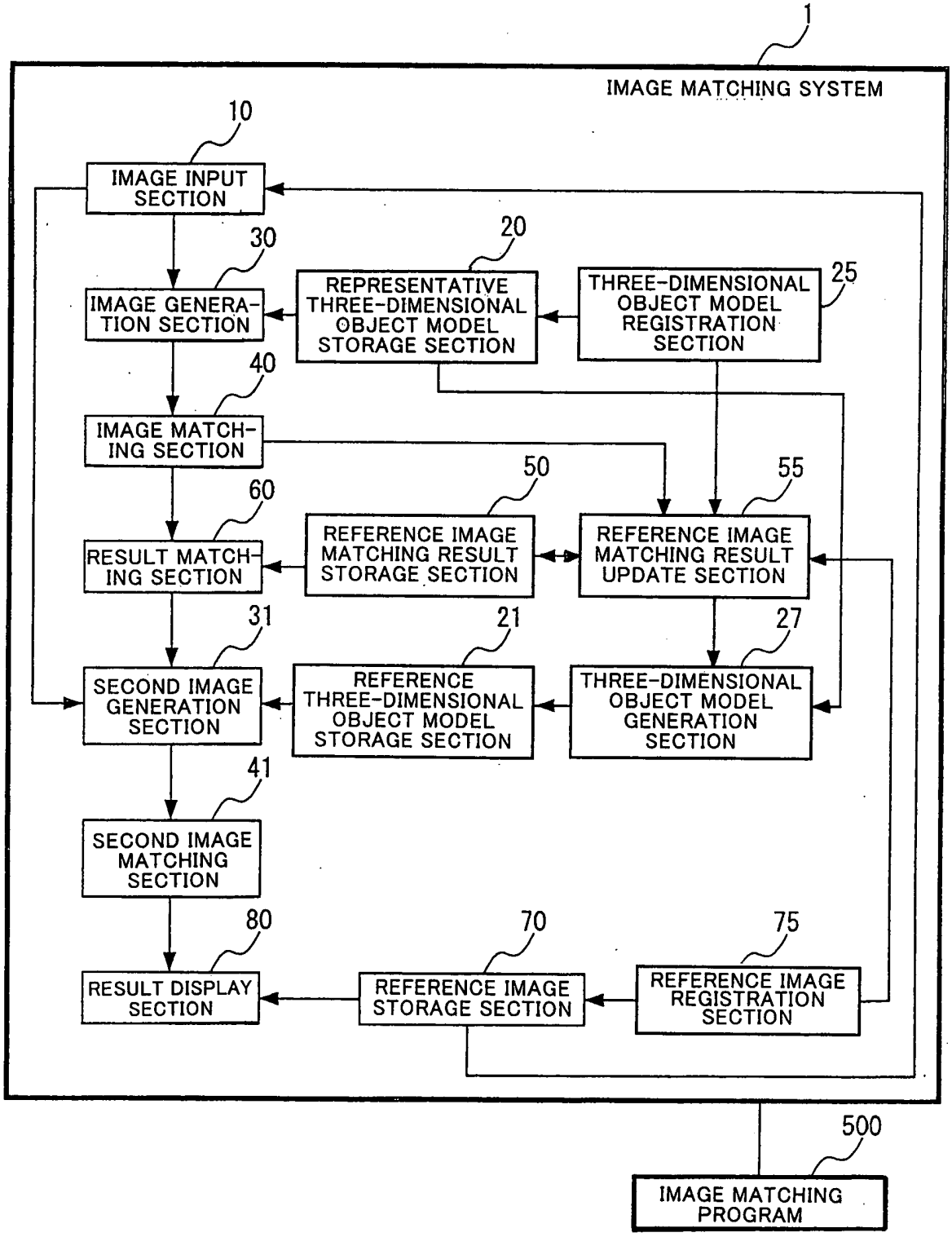
1
IMAGE MATCHING SYSTEM
10
IMAGE INPUT SECTION
30
IMAGE GENERATION SECTION
20
REPRESENTATIVE THREE-DIMENSIONAL OBJECT MODEL STORAGE SECTION
25
THREE-DIMENSIONAL OBJECT MODEL REGISTRATION SECTION
40
IMAGE MATCHING SECTION
50
55
60
RESULT MATCHING SECTION
REFERENCE IMAGE MATCHING RESULT STORAGE SECTION
REFERENCE IMAGE MATCHING RESULT UPDATE SECTION
31
21
27
SECOND IMAGE GENERATION SECTION
REFERENCE THREE-DIMENSIONAL OBJECT MODEL STORAGE SECTION
THREE-DIMENSIONAL OBJECT MODEL GENERATION SECTION
41
SECOND IMAGE MATCHING SECTION
80
70
75
RESULT DISPLAY SECTION
REFERENCE IMAGE STORAGE SECTION
REFERENCE IMAGE REGISTRATION SECTION
500
IMAGE MATCHING PROGRAM

FIG.21

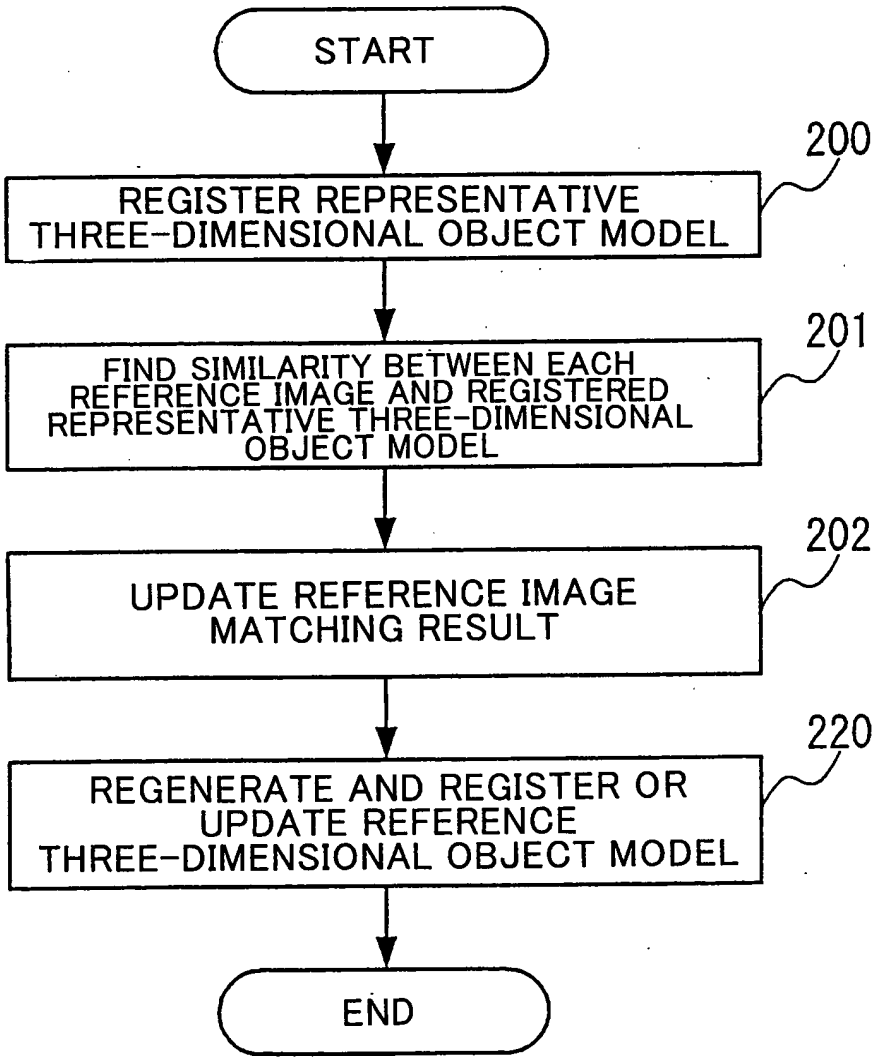
START
200
REGISTER REPRESENTATIVE THREE-DIMENSIONAL OBJECT MODEL
201
FIND SIMILARITY BETWEEN EACH REFERENCE IMAGE AND REGISTERED REPRESENTATIVE THREE-DIMENSIONAL OBJECT MODEL
202
UPDATE REFERENCE IMAGE MATCHING RESULT
220
REGENERATE AND REGISTER OR UPDATE REFERENCE THREE-DIMENSIONAL OBJECT MODEL
END

FIG.22

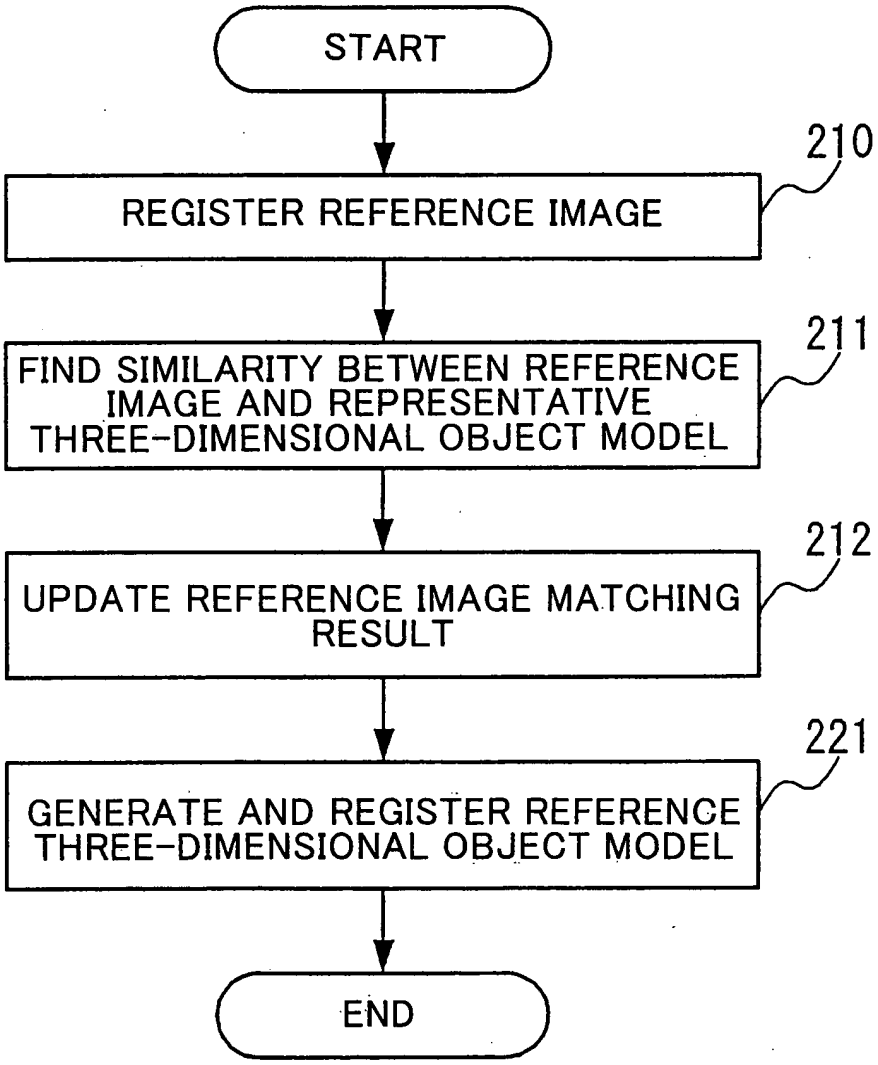
START
210
REGISTER REFERENCE IMAGE
211
FIND SIMILARITY BETWEEN REFERENCE IMAGE AND REPRESENTATIVE THREE-DIMENSIONAL OBJECT MODEL
212
UPDATE REFERENCE IMAGE MATCHING RESULT
221
GENERATE AND REGISTER REFERENCE THREE-DIMENSIONAL OBJECT MODEL
END

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FIG.23

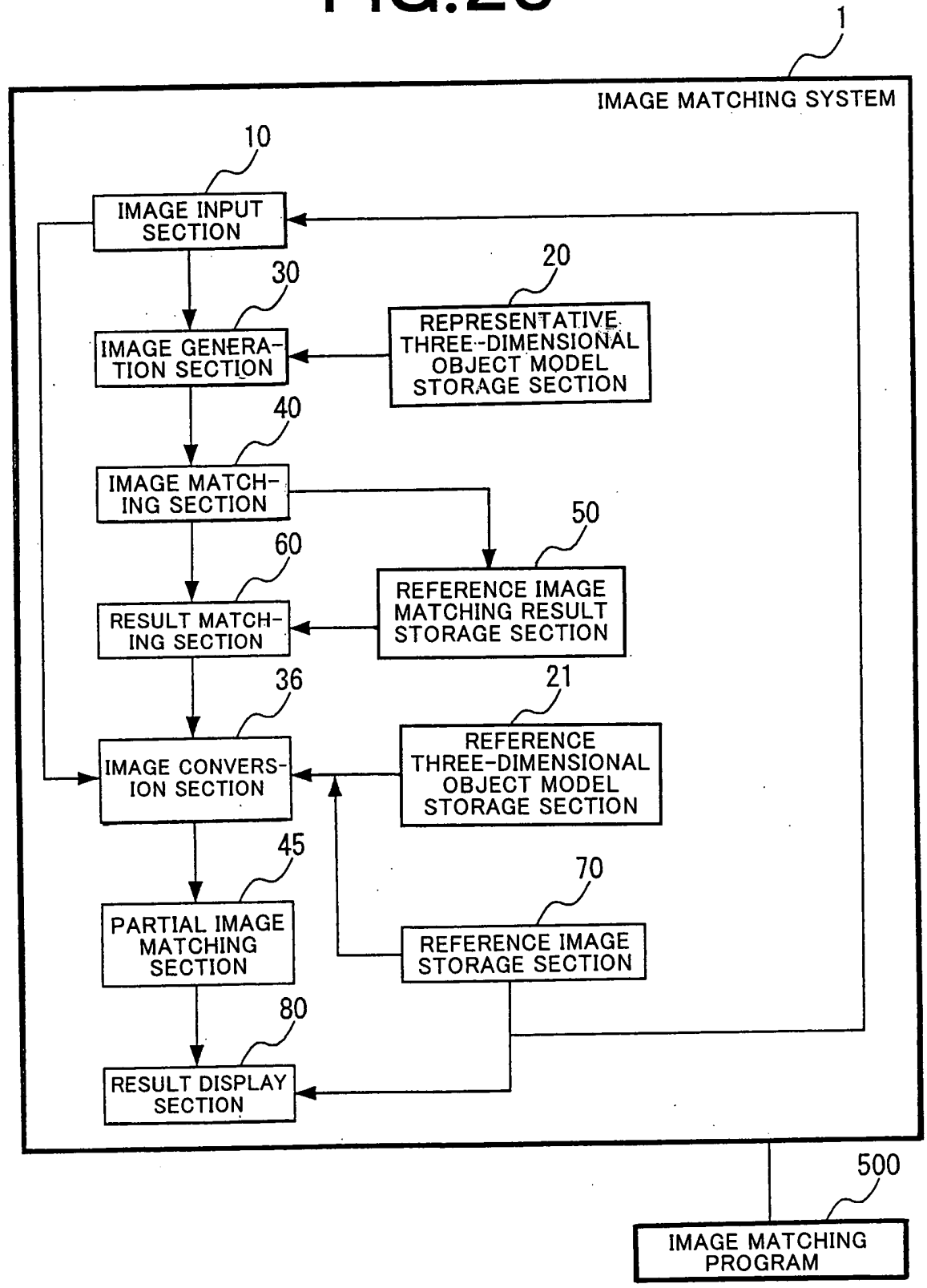


FIG.24

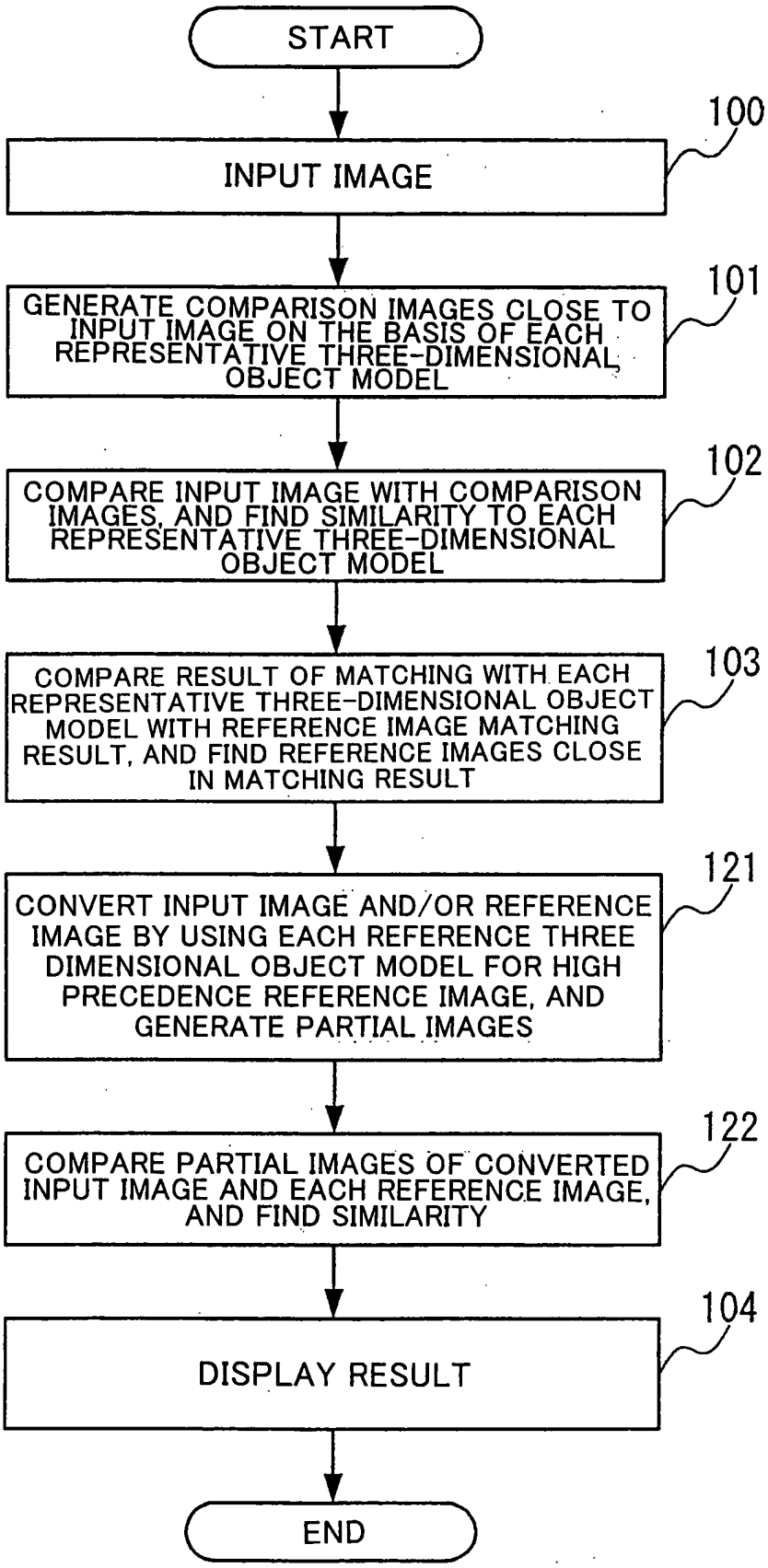

START
100
INPUT IMAGE
101
GENERATE COMPARISON IMAGES CLOSE TO INPUT IMAGE ON THE BASIS OF EACH REPRESENTATIVE THREE-DIMENSIONAL OBJECT MODEL
102
COMPARE INPUT IMAGE WITH COMPARISON IMAGES, AND FIND SIMILARITY TO EACH REPRESENTATIVE THREE-DIMENSIONAL OBJECT MODEL
103
COMPARE RESULT OF MATCHING WITH EACH REPRESENTATIVE THREE-DIMENSIONAL OBJECT MODEL WITH REFERENCE IMAGE MATCHING RESULT, AND FIND REFERENCE IMAGES CLOSE IN MATCHING RESULT
121
CONVERT INPUT IMAGE AND/OR REFERENCE IMAGE BY USING EACH REFERENCE THREE DIMENSIONAL OBJECT MODEL FOR HIGH PRECEDENCE REFERENCE IMAGE, AND GENERATE PARTIAL IMAGES
122
COMPARE PARTIAL IMAGES OF CONVERTED INPUT IMAGE AND EACH REFERENCE IMAGE, AND FIND SIMILARITY
104
DISPLAY RESULT
END

FIG.25

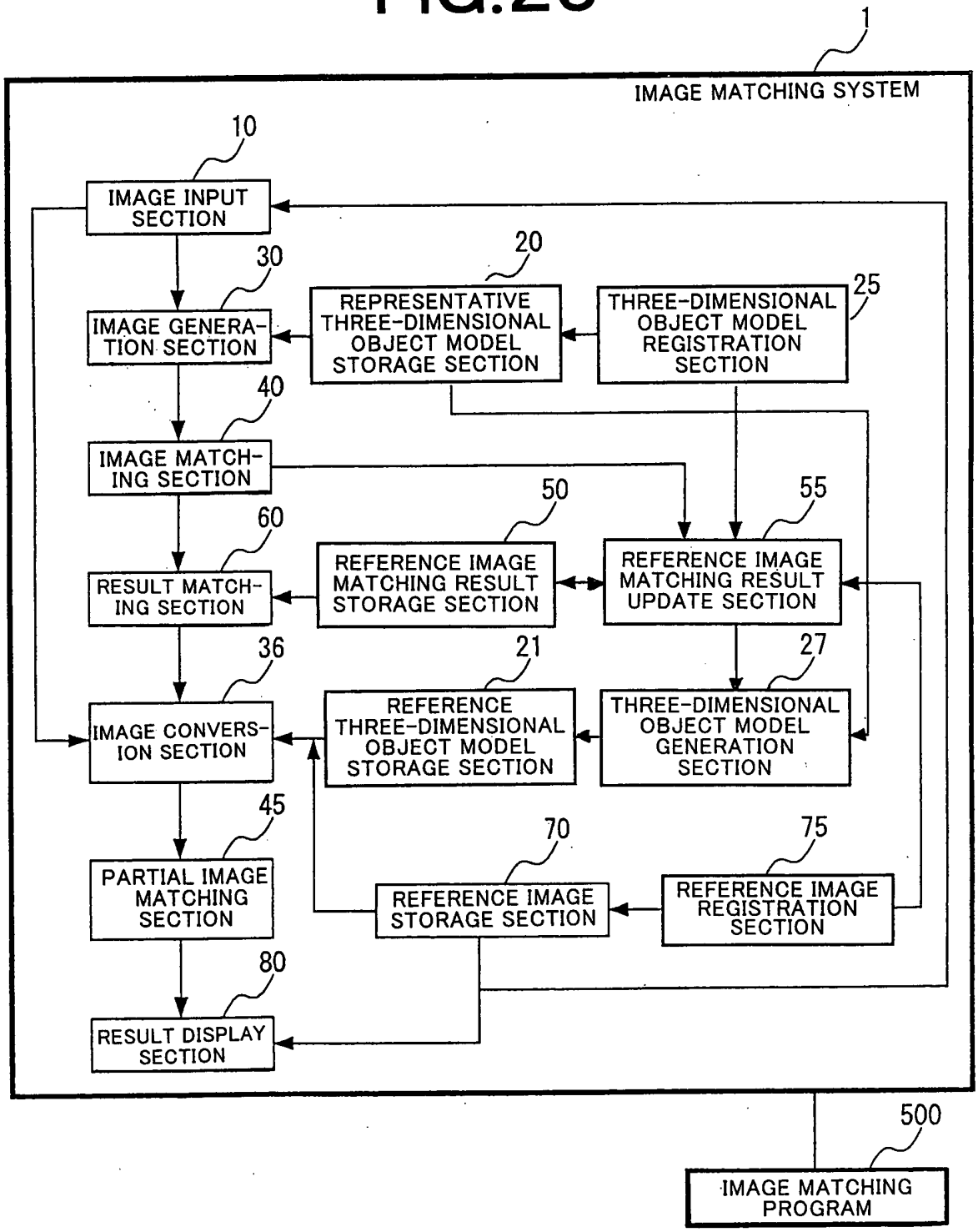

1
IMAGE MATCHING SYSTEM
10
IMAGE INPUT SECTION
30
IMAGE GENERATION SECTION
20
REPRESENTATIVE THREE-DIMENSIONAL OBJECT MODEL STORAGE SECTION
25
THREE-DIMENSIONAL OBJECT MODEL REGISTRATION SECTION
40
IMAGE MATCHING SECTION
50
55
60
RESULT MATCHING SECTION
REFERENCE IMAGE MATCHING RESULT STORAGE SECTION
REFERENCE IMAGE MATCHING RESULT UPDATE SECTION
36
21
27
IMAGE CONVERSION SECTION
REFERENCE THREE-DIMENSIONAL OBJECT MODEL STORAGE SECTION
THREE-DIMENSIONAL OBJECT MODEL GENERATION SECTION
45
70
75
PARTIAL IMAGE MATCHING SECTION
REFERENCE IMAGE STORAGE SECTION
REFERENCE IMAGE REGISTRATION SECTION
80
RESULT DISPLAY SECTION
500
IMAGE MATCHING PROGRAM

FIG.26

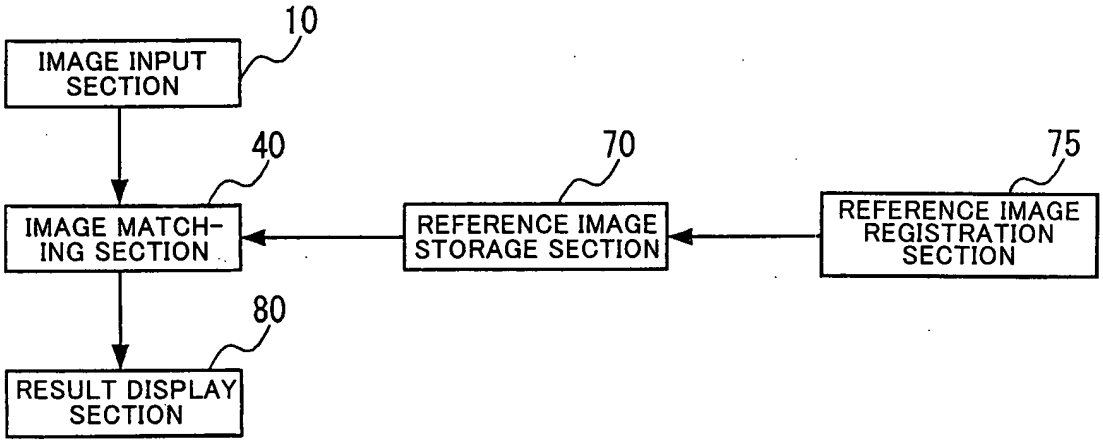

10
IMAGE INPUT SECTION
40
IMAGE MATCH-ING SECTION
70
REFERENCE IMAGE STORAGE SECTION
75
REFERENCE IMAGE REGISTRATION SECTION
80
RESULT DISPLAY SECTION

FIG.27

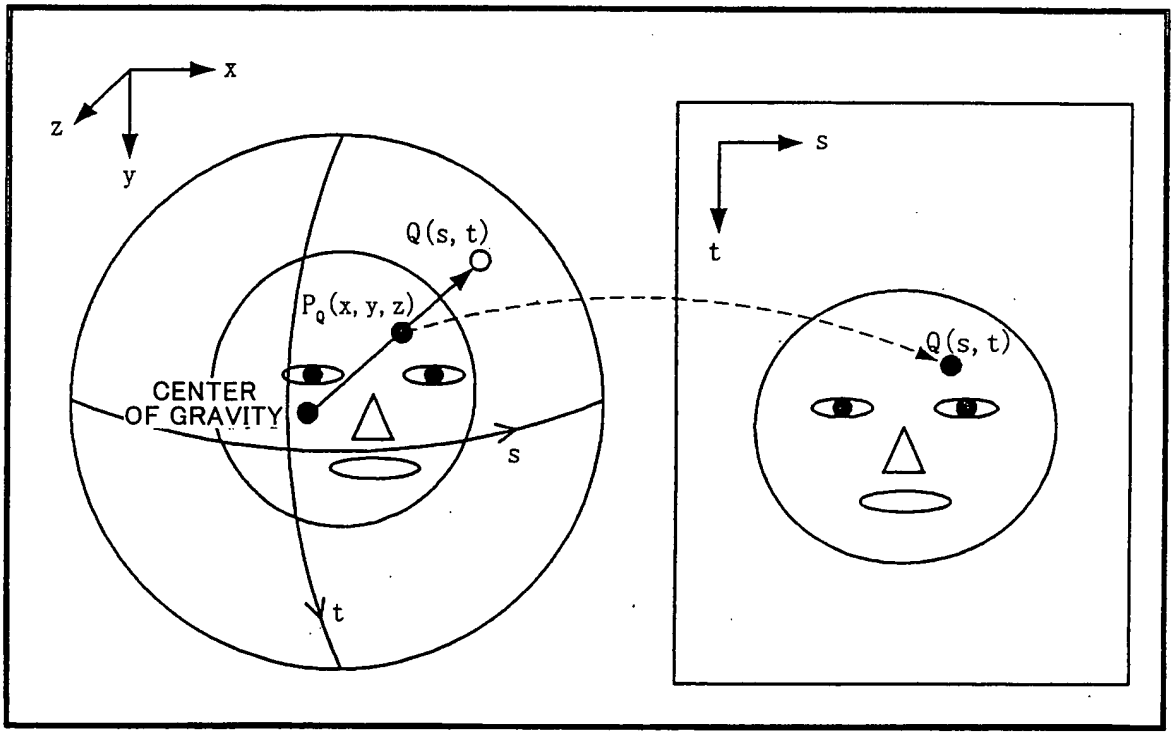
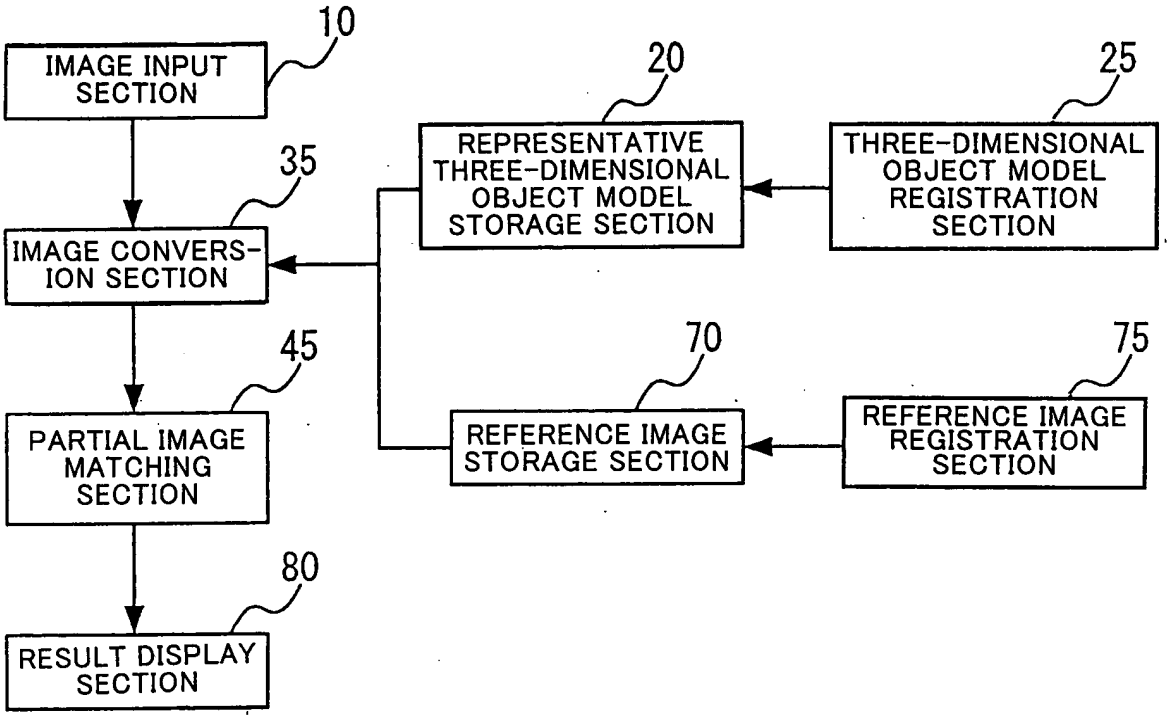

x
z
y
Q(s, t)
$P_Q(x, y, z)$
CENTER OF GRAVITY
s
t
s
t
Q(s, t)

FIG.28


10
IMAGE INPUT SECTION
20
REPRESENTATIVE THREE-DIMENSIONAL OBJECT MODEL STORAGE SECTION
25
THREE-DIMENSIONAL OBJECT MODEL REGISTRATION SECTION
35
IMAGE CONVERSION SECTION
45
PARTIAL IMAGE MATCHING SECTION
70
REFERENCE IMAGE STORAGE SECTION
75
REFERENCE IMAGE REGISTRATION SECTION
80
RESULT DISPLAY SECTION

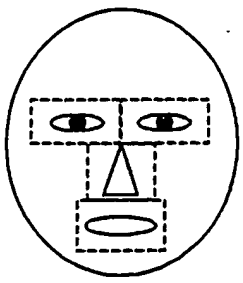



FIG.29